The Use of Collaborative Rerouting Procedures Instead of Miles-in-Trail Restrictions for Managing National Airspace System Choke Points

Paul Rigterink and Ed Ellenberger
Computer Sciences Corporation
15245 Shady Grove Road
Rockville, MD 20854

Agenda

- **Review of Bureau of Transportation Statistics Data**
- **Review of DOT Office of Aviation Enforcement and Proceedings (OAEP) “Air Travel Consumer Report” Data**
- **Current Use of MIT Restrictions**
- **Current Use of Rerouting**
- **Current Use of GDPs and GSs**
- **Obtaining the Proper Balance in the Use of MIT, Rerouting, GDP, GS Initiatives**
- **Sample Choke Points**
- **Identifying Candidates for Collaborative Rerouting Procedures Using Recent Historical Data**
- **Sample Tool Set for Fully Planning a Collaborative Rerouting Strategy**

Bureau of Transportations Statistics Data

- Provides historical comparisons of monthly on-time reports filed by large airlines.
- Flights are on-time if they depart from the gate or arrive at the gate less than 15 minutes after their scheduled departure or arrival times.
- Summary data reported is given below
- Percent of late time arrivals and departures will continue to increase as the volume of air traffic continues to increase
  - Need new procedures and systems are developed to handle the increased traffic load.

Summary of Airline On-Time Performance Year-to-date through December 2005

Year	Operations	Late Arrivals	Late Departures	Cancelled	Diverted	Percent On-Time Arrivals	Percent Late Arrivals	Percent Late Departures	Percent Cancelled	Percent Diverted
1995	5,327,435	1,039,250	827,934	91,905	10,492	78.57	19.51	15.54	1.73	0.2
1996	5,351,983	1,220,045	973,948	128,536	14,121	74.54	22.8	18.2	2.4	0.26
1997	5,411,843	1,083,834	846,870	97,763	12,081	77.94	20.03	15.65	1.81	0.22
1998	5,384,721	1,070,071	870,395	144,509	13,161	77.2	19.87	16.16	2.68	0.24
1999	5,527,884	1,152,725	937,273	154,311	13,555	76.11	20.85	16.96	2.79	0.25
2000	5,683,047	1,356,040	1,131,663	187,490	14,254	72.59	23.86	19.91	3.3	0.25
2001	5,967,780	1,104,439	953,808	231,198	12,909	77.4	18.51	15.98	3.87	0.22
2002	5,271,359	868,225	717,368	65,143	8,356	82.14	16.47	13.61	1.24	0.16
2003	6,488,540	1,057,804	834,390	101,469	11,381	81.96	16.3	12.86	1.56	0.18
2004	7,129,270	1,421,391	1,187,594	127,757	13,784	78.08	19.94	16.66	1.79	0.19
2005	7,140,596	1,466,065	1,279,404	133,730	14,028	77.4	20.53	17.92	1.87	0.2

SOURCE: Bureau of Transportation Statistics, Airline On-Time Data

Bureau of Transportations Statistics Data

Ranking of Major Airport On-Time Arrival Performance Year-to-Date through December 2005 (Percent on-Time)

Ranking of Major Airport On-Time Arrival Performance Year-to-Date through December 2005 (Percent on-Time)

Rank	Jan 1 - December 31, 2004	%	Rank	Jan 1 - December 31, 2005	%
1	Denver, CO (DEN)	83.12	1	Salt Lake City, UT (SLC)	83.46
2	Charlotte, NC (CLT)	83.12	2	Cincinnati, OH (CVG)	82.65
3	Salt Lake City, UT (SLC)	82.24	3	Denver, CO (DEN)	82.45
4	Los Angeles, CA (LAX)	81.66	4	Chicago, IL (MDW)	82.34
5	Detroit, MI (DTW)	81.41	5	Houston, TX (IAH)	81.50
6	Oakland, CA (OAK)	81.29	6	Dallas/Ft.Worth, TX (DFW)	81.30
7	Dallas/Ft.Worth, TX (DFW)	81.18	7	Phoenix, AZ (PHX)	81.08
8	Houston, TX (IAH)	81.00	8	St. Louis, MO (STL)	80.57
9	Baltimore, MD (BWI)	80.83	9	Baltimore, MD (BWI)	80.21
10	Washington, DC (DCA)	80.69	10	Los Angeles, CA (LAX)	80.12
11	Pittsburgh, PA (PIT)	80.62	11	Charlotte, NC (CLT)	79.85
12	St. Louis, MO (STL)	80.56	12	Oakland, CA (OAK)	79.52
13	Minneapolis/St. Paul, MN (MSP)	80.49	13	San Diego, CA (SAN)	79.17
14	San Diego, CA (SAN)	80.06	14	Washington, DC (IAD)	79.05
15	Phoenix, AZ (PHX)	79.97	15	Washington, DC (DCA)	78.68
16	Cincinnati, OH (CVG)	79.92	16	Pittsburgh, PA (PIT)	78.54
17	Portland, OR (PDX)	79.40	17	Minneapolis/St. Paul, MN (MSP)	78.20
18	Chicago, IL (MDW)	79.32	18	Detroit, MI (DTW)	78.06
19	Tampa, FL (TPA)	79.28	19	Las Vegas, NV (LAS)	77.83
20	Washington, DC (IAD)	78.37	20	Portland, OR (PDX)	77.64
21	Orlando, FL (MCO)	77.98	21	Orlando, FL (MCO)	77.52
22	Boston, MA (BOS)	77.91	22	Tampa, FL (TPA)	77.03
23	Miami, FL (MIA)	77.81	23	San Francisco, CA (SFO)	75.12
24	Seattle, WA (SEA)	77.79	24	Chicago, IL (ORD)	74.92
25	Las Vegas, NV (LAS)	77.65	25	Seattle, WA (SEA)	74.54
26	San Francisco, CA (SFO)	76.94	26	Miami, FL (MIA)	74.02
27	New York, NY (JFK)	76.12	27	Boston, MA (BOS)	72.49
28	Fort Lauderdale, FL (FLL)	75.64	28	Atlanta, GA (ATL)	71.87
29	Philadelphia, PA (PHL)	73.45	29	Philadelphia, PA (PHL)	71.77
30	New York, NY (LGA)	73.33	30	Fort Lauderdale, FL (FLL)	71.10
31	Atlanta, GA (ATL)	72.89	31	New York, NY (JFK)	70.27
32	Newark, NJ (EWR)	71.22	32	New York, NY (LGA)	66.71
33	Chicago, IL (ORD)	70.07	33	Newark, NJ (EWR)	64.10

SOURCE: Bureau of Transportation Statistics, Airline On-Time Data

Bureau of Transportations Statistics Data

Ranking of Major Airport On-Time Departure Performance Year-to-date through December 2005 (Percent on-Time)

Rank	Jan 1 - December 31, 2004	%	Rank	Jan 1 - December 31, 2005	%
1	Houston, TX (IAH)	87.19	1	Salt Lake City, UT (SLC)	85.09
2	Washington, DC (DCA)	86.29	2	Houston, TX (IAH)	84.97
3	Salt Lake City, UT (SLC)	86.08	3	Cincinnati, OH (CVG)	83.73
4	San Francisco, CA (SFO)	85.34	4	San Diego, CA (SAN)	83.40
5	Denver, CO (DEN)	85.10	5	Los Angeles, CA (LAX)	83.22
6	Los Angeles, CA (LAX)	84.97	6	Pittsburgh, PA (PIT)	82.99
7	Portland, OR (PDX)	84.75	7	Portland, OR (PDX)	82.98
8	Minneapolis/St. Paul, MN (MSP)	84.70	8	St. Louis, MO (STL)	82.75
9	San Diego, CA (SAN)	83.90	9	Washington, DC (DCA)	82.60
10	Tampa, FL (TPA)	83.86	10	San Francisco, CA (SFO)	82.15
11	Pittsburgh, PA (PIT)	83.52	11	Denver, CO (DEN)	81.53
12	St. Louis, MO (STL)	83.52	12	Tampa, FL (TPA)	81.17
13	Charlotte, NC (CLT)	83.10	13	Washington, DC (IAD)	80.43
14	Detroit, MI (DTW)	82.70	14	Charlotte, NC (CLT)	80.31
15	Boston, MA (BOS)	82.07	15	Orlando, FL (MCO)	80.13
16	Oakland, CA (OAK)	81.97	16	Phoenix, AZ (PHX)	79.69
17	Orlando, FL (MCO)	81.97	17	Dallas/Ft.Worth, TX (DFW)	79.66
18	New York, NY (LGA)	81.78	18	Minneapolis/St. Paul, MN (MSP)	79.47
19	Fort Lauderdale, FL (FLL)	81.39	19	Baltimore, MD (BWI)	79.14
20	Dallas/Ft.Worth, TX (DFW)	80.77	20	Oakland, CA (OAK)	79.12
21	Cincinnati, OH (CVG)	80.56	21	Boston, MA (BOS)	78.56
22	Baltimore, MD (BWI)	80.54	22	New York, NY (LGA)	77.87
23	New York, NY (JFK)	80.35	23	Detroit, MI (DTW)	77.80
24	Seattle, WA (SEA)	80.16	24	Seattle, WA (SEA)	77.42
25	Newark, NJ (EWR)	80.15	25	Chicago, IL (MDW)	77.27
26	Miami, FL (MIA)	80.14	26	New York, NY (JFK)	76.75
27	Washington, DC (IAD)	80.08	27	Las Vegas, NV (LAS)	76.62
28	Phoenix, AZ (PHX)	79.29	28	Miami, FL (MIA)	76.16
29	Las Vegas, NV (LAS)	77.87	29	Fort Lauderdale, FL (FLL)	75.75
30	Chicago, IL (MDW)	77.74	30	Newark, NJ (EWR)	74.90
31	Atlanta, GA (ATL)	76.10	31	Chicago, IL (ORD)	73.73
32	Philadelphia, PA (PHL)	74.17	32	Atlanta, GA (ATL)	73.23
33	Chicago, IL (ORD)	72.84	33	Philadelphia, PA (PHL)	71.89

SOURCE: Bureau of Transportation Statistics, Airline On-Time Data

DOT Office of Aviation Enforcement and Proceedings (OAEP) "Air Travel Consumer Report"

Table 5 lists the most frequently delayed flights, showing the percentage of each flight operation that was late that month and the average and median number of minutes the flight was late.

RRIER*	FLIGHT NUMBER	ORGIN-DESTIN. AIRPORTS	SCHEDULED DEPARTURE TIME	NUMBER OF OPERATIONS REPORTED	PERCENTAGE OF FLIGHT OPERATIONS ARRIVING 15 MINUTES LATE OR MORE D/	NUMBER OF MIN LATE AVERAGE	MEDIAN
FL	41	ATL-LAX	2115	28	100.00	50	36
DH	805	LAX-IAD	2359	18	88.89	42	26
AS	519	LAX-SEA	1711	31	87.10	81	53
RU	2165	EWR-MHT	915	21	85.71	29	32
WN	1660	LAS-PHX	1715	27	81.48	37	32
AS	576	SEA-LAX	1410	31	80.65	70	49
AS	76	JNU-SEA	1357	31	80.65	67	62
AS	333	SMF-SEA	1836	31	80.65	62	48
AS	413	SEA-GEG	2100	31	80.65	54	38
AS	720	SEA-PHX	1835	31	80.65	51	35
AS	547	LAX-SEA	1400	31	80.65	48	28
AS	392	SEA-OAK	1219	31	80.65	47	26
AS	670	SEA-LAS	1715	31	80.65	44	33
RU	2919	EWR-IAD	1500	31	80.65	39	30
US	1610	DCA-PWM	2050	20	80.00	40	17

DOT Office of Aviation Enforcement and Proceedings (OAEP) "Air Travel Consumer Report"

Number of Entries in the DOT OAEP "Air Travel Consumer Report" List of Regularly Scheduled Flights Arriving 15 Minutes Late or More 80% of the Time or More during 2003-2005

Month	Number of Regularly Scheduled Flights Arriving 15 Minutes Late or More 80% of the Time or More (2003 data)	Number of Regularly Scheduled Flights Arriving 15 Minutes Late or More 80% of the Time or More (2004 data)	Number of Regularly Scheduled Flights Arriving 15 Minutes Late or More 80% of the Time or More (2005 data)
January	1	54	25
February	19	29	22
March	3	19	37
April	1	3	5
May	1	58	15
June	9	78	134
July	18	50	420
August	20	21	176
September	25	4	18
October	0	1	51
November	59	8	30
December	55	35	118

Current Use of Miles-in-Trail Restrictions

- MIT are often used when the NAS is impacted by severe weather
- Airlines and the FAA want to reduce the use of MIT restrictions.
  - Major pacing airports, in particular, would like to reduce the use of MIT restrictions .
- MIT are imposed as an operationally expedient (but overly restrictive) way to limit flights
  - Easier to impose MIT for a single pacing airport than large number of satellite airports
  - MIT unnecessarily delays flights from the restricted airport that may not even pass through a “choke point” area.
  - Disruption of traffic flow to one destination will affect the operations of the airport, which, in turn, affects the traffic flow to other destinations.
  - Particularly important not to disrupt “The Golden Triangle”

Sample Choke Points

- International flights landing at U.S. airports transiting the Boston Air Route Traffic Control Center (ZBW) airspace
- Dulles (IAD) airport arrivals departing from the New York (ZNY) and Boston (ZBW) control areas.
- Westbound departure flows to the Chicago O'Hare (ORD), Chicago Midway (MDW), and Detroit Metropolitan (DTW) airports as well as over-flights destined for airports in the Minneapolis (ZMP), Denver (ZDV), Salt Lake (ZLC), Seattle (ZSE), and Oakland (ZOA) control areas.
- Delays out of the Atlanta Hartsfield International airport (ATL) to ORD, with over-flights departing from the Miami (ZMA) and Jacksonville (ZJX) center areas.
- Future airline hub operations at the Fort Lauderdale Airport (FLL) (arrivals and departures).
- ATL arrivals from the Northeast.
- Florida and Caribbean flights to and from the Northeast. (Canadian, ZBW, ZNY, and Washington (ZDC) effort

Current Use of Rerouting

- Rerouting is the technique usually used to circumvent severe weather
  - Much less frequently used to ease a congestion problem in clear weather conditions.
- ARTCCs do not completely take into consideration terminal airspace and active runways availabilility in clear weather conditions.
- TRACONs) normally can handle more aircraft than an ARTCC can provide
- Suggest that ATM personnel always should consider rerouting excess aircraft

Current Use of Ground Delay Programs (GDPs) and Ground Stops (GSs)

- GDPs and GSs are the most restrictive types of TFM initiatives.
- GDPs are national initiatives of delays of over 1 hour and are planned 3-4 hours in advance,
- GSs are implemented immediately and can be either locally or nationally implemented.
  - GS of 30 minutes or less is implemented as a local initiative and those that are longer are typically implemented nationally.
  - GS is predicated on departure times at the origin while GDP is predicated on arrival times at the destination
- Lengthy periods of demand exceeding acceptance rate are normally a result of the airport's acceptance rate being reduced
  - Most common reason is adverse weather such as low ceilings and visibility

Obtaining the Proper Balance in the Use of MIT, Rerouting, GDP, and GS Initiatives

- Current air traffic management procedures based primarily on past experience
  - Current procedures have been very successful
- Obtaining the proper balance in the use of MIT, rerouting, GDP, GS initiatives in the future most likely will require the use of new procedures tools, and data
- In the near term a decision support tool needs to be developed that identifies flights that are candidates for rerouting
  - Ideal tool will be able to
    - Identify flights that are candidates for rerouting 24 hours in advance
    - Update the candidate reroute list based on current conditions for all flights that are scheduled to depart in the next two hours.
  - Existing CDM teams will use the candidate reroute list to develop and implement a rerouting strategy.
  - Rerouted aircraft need to be notified at least 20 minutes before they depart from an airport

DOT Office of Aviation Enforcement and Proceedings (OAEP) "Air Travel Consumer Report"

- **Should these flights have been delayed or rerouted?**
- **CDM must identify candidates for collaborative rerouting the prior day and then take appropriate action based on current conditions**

RRIER*	FLIGHT NUMBER	ORGIN-DESTIN. AIRPORTS	SCHEDULED DEPARTURE TIME	NUMBER OF OPERATIONS REPORTED	PERCENTAGE OF FLIGHT OPERATIONS ARRIVING 15 MINUTES LATE OR MORE D/	NUMBER OF MIN LATE AVERAGE	MEDIAN
FL	41	ATL-LAX	2115	28	100.00	50	36
DH	805	LAX-IAD	2359	18	88.89	42	26
AS	519	LAX-SEA	1711	31	87.10	81	53
RU	2165	EWR-MHT	915	21	85.71	29	32
WN	1660	LAS-PHX	1715	27	81.48	37	32
AS	576	SEA-LAX	1410	31	80.65	70	49
AS	76	JNU-SEA	1357	31	80.65	67	62
AS	333	SMF-SEA	1836	31	80.65	62	48
AS	413	SEA-GEG	2100	31	80.65	54	38
AS	720	SEA-PHX	1835	31	80.65	51	35
AS	547	LAX-SEA	1400	31	80.65	48	28
AS	392	SEA-OAK	1219	31	80.65	47	26
AS	670	SEA-LAS	1715	31	80.65	44	33
RU	2919	EWR-IAD	1500	31	80.65	39	30
US	1610	DCA-PWM	2050	20	80.00	40	17

Sample Tool Set for Fully Planning a Rerouting Strategy

- System Wide Evaluation and Planning Tool (SWEPT)
- Traffic Flow Management – Modernization (TFM-M)
- Departure Space Program (DSP) or equivalent technology,
- Departure Release Coordination System (DRCS) or equivalent technology,
- System Wide Information Management (SWIM)
- Network Enabled Operations (NEO)
- Corridor Integrated Weather System (CIWS)
- Integrated Terminal Weather System (ITWS)